CDM

Memorandum

To: *Wayne Pickus, P.E.*

From: *John E. Newby, P.E., G.E.*

Date: *February 22, 2007*

Subject: *USG Plaster City Landfill Stability*

A. Background

The stability of the Plaster City Gypsum Landfill cover was evaluated by CDM as part of the design for the final cover of the landfill. The analysis and this report were conducted in accordance with CIWMB requirements as noted in CCR Section 21750 (f) (5) Stability Analysis.

B. Site Geology and Seismicity

CDM (and its predecessor, AGI) have conducted engineering and environmental studies at the USG Plaster City facility since the 1980's. The geology and hydrogeology of the landfill were initially evaluated by AGI in 1987-1988 and presented in *Solid Waste Assessment Test [SWAT], US Gypsum, Plaster City, California.*

As part of the SWAT, ten (10) soil borings were drilled in the landfill to a maximum depth of 53 feet. The soil borings indicate that the landfill is underlain by Older Alluvium (Qc) then the Palm Spring Formation (Pcp). Older Alluvium consists of poorly sorted, semi-consolidated silts, sands and gravel. The Palm Spring Formation underlies the Older Alluvium and is composed of a thick sequence of weakly to moderately consolidated interbedded light gray non-marine arkosic sandstone, fine-grained light brown sand and reddish clay.

During a November 1987 earthquake, a NE trending left lateral fault was discovered approximately 3,300 feet NW of Plaster City. Based on mapping (USGS 2006), this appears to be related to the Yuha Wells fault. There are no historic earthquakes having a magnitude (M) greater than 5.5 related to this fault (CDMG 2000). Faults in the vicinity of Plaster City, which are related to historic earthquakes with M greater than 5.5, include the Superstition Mountain Fault (10 miles NE) and Superstition Hills Fault (13.5 miles NE) of the San Jacinto Fault Zone, and the Coyote Mountain Section (10 miles E) of the Elsinore Fault Zone. These locations are presented on Figure 1 of the Appendix.

C. Subsurface Conditions

Subsurface conditions at the landfill were investigated by completing ten soil borings to depths up to 53 feet below ground surface (ft, bgs). Landfill surface elevations at the time of soil boring drilling ranged from about 106 ft to 116 ft.

Samples from the borings were obtained in general accordance with the Standard Penetration Test (ASTM D 1586). The SPT consists of driving a sampler into the bottom of the boring with a 140 pound weight free falling 30 inches. The number of blows required to drive the sampler 18 inches through three, 6-inch increments is recorded on the field logs. The SPT Resistance, or N-value, is the number of blows required to drive the sampler from 6 to 18 inches. The N-value provides a means for evaluating the relative density or compactness of cohesionless (granular) soil and consistency or stiffness of cohesive (fine-grained) soil. When the penetration resistance exceeded 50 blows for 6 inches or less of penetration, the test was stopped and the number of blows and corresponding penetration was recorded.

1. Soils/Waste

In general, the borings encountered Gypsum Landfill materials overlying older alluvium (Qc) then the Palm Spring Formation (Pcp). The landfill materials were described as a mixture of gypsum wallboard, stucco, powder and sand. These materials were classified as medium dense to dense based on SPT N-values, and described as being dry. Gypsum waste thickness ranged up to about 15 feet, with an average of about 12 feet. Based on a recent survey, the waste thickness averages about 30 feet, with a maximum of about 40 feet. The underlying native soils – Alluvium and Palm Spring Formation were described as dense to very dense, fine grained sand, with interlayers of stiff clay.

2. Groundwater

The regional groundwater is at about Elev. 0 (AGI 1988), or approximately 125+ feet below the current landfill surface. Groundwater measurements were made in two monitor wells on the site. These wells indicated that the groundwater elevation varied from about Elev. 50 in the SE area of the landfill to Elev. 20 in the NW.

3. Liquefaction Potential

Due to the relatively dense soil conditions and deep groundwater, the site is not considered prone to liquefaction during an earthquake.

D. Methodology

1. Soil Strength Parameters

Soil strength parameters were obtained using correlations of the SPT N-values. Average N-values for three landfill sample depths were used; the calculations are shown on Figure 2 of the Appendix. The values used for the analysis are shown in Table 1; these are considered to be conservative values.

Table 1. Material Properties for Slope Stability Analyses

Material Type	Total Unit Weight, δ_t (pcf)	Cohesion, C' (psf)	Effective Friction Angle, ϕ'
Landfill Material	105	2	35
Native Sand (Qc /Pcp)	115	0	38

2. Design Earthquake

CIWMB requires that the Maximum Probable Earthquake (MPE) be used as the design earthquake for stability analysis of Class III landfills. The MPE equates to 10 percent (%) probability of exceedance in 50 years. Peak ground acceleration (PGA) was determined from the U.S. Geological Survey (USGS 2005). Based on the USGS data, a PGA with a 10% chance of exceedance in 50 years is equal to 42% of the acceleration due to gravity (0.42g). The USGS data is based on historic earthquake location and magnitude as they relate to the Plaster City site.

3. Stability Analysis

A critical cross section was created using the current site survey map and the subsurface data. The cross section and its location are attached on Figures 3 and 4. The stability analysis was conducted using the Spencer method with the computer program SLOPE/W (Geo-Slope, 2004). SLOPE/W performs a search routine to find the most critical slip surface.

The analyses were performed for both static and seismic cases. The seismic stability of the slope was evaluated for the design ground acceleration using the pseudostatic method. In this method the effect of an earthquake force is added to the analysis and is represented as a static force equal to the mass of the slide times a seismic coefficient. The seismic coefficient is generally one-half (0.5) the peak ground acceleration (USACE 2003). For this case, the seismic coefficient (K_h) was taken as 0.21. Due to the minimal probability of liquefaction, the strength of the landfill material was not reduced in the pseudostatic analyses.

E. Results

The results of the stability analyses are presented on Figures 5 and 6 in the Appendix and summarized on Table 2.

Table 2. Summary of Slope Stability Analyses

Cross Section	Minimum FS
1 -- Static	4.40
1 -- Seismic	1.86

F. Conclusions

Based on the stability analysis conducted, the proposed cover slopes will have adequate factors of safety under static and seismic loading conforming to CIWMB criteria.

References

Applied Geotechnology Inc. 1988. *Solid Waste Assessment Test, US Gypsum, Plaster City, California,* a report prepared for US Gypsum. June 28.

California Division of Mines and Geology. 2000. *Epicenters of and Areas Damaged by M>5.5 California Earthquakes, 1800-1999.*

GEO-SLOPE International, Ltd. 2004. *Stability Modeling with SLOPE/W.*

United States Army Corps of Engineers. 2003. *Slope Stability. EM 1110-2-1902, 31 October.*

United States Geological Survey. 2006. *Quaternary Fault and Fold Database for the United States, El Centro 1° x 2° Sheet.* January 13.

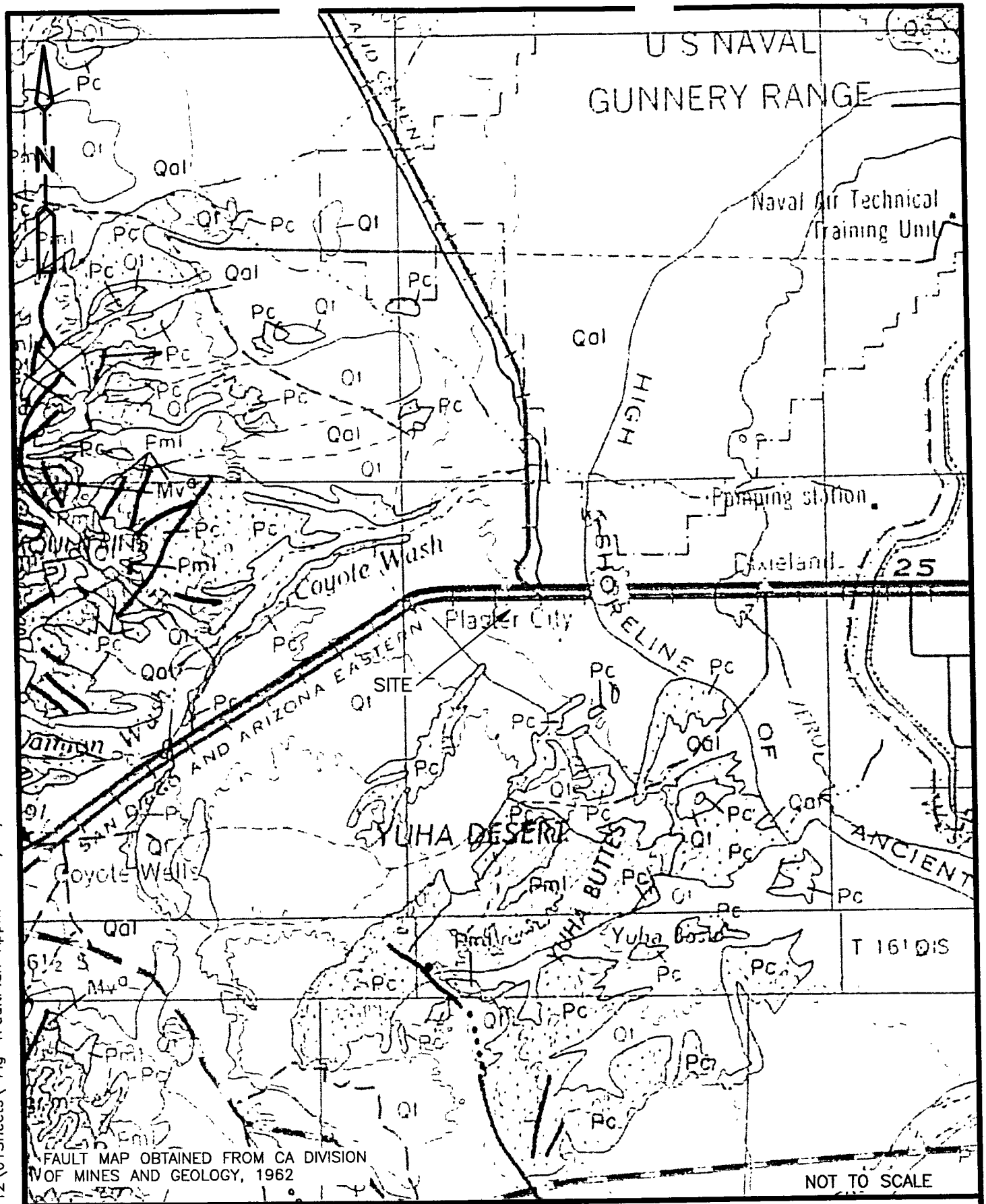
United States Geological Survey. 2005. *Seismic Hazard, Earthquake Hazards Program.* http://eqhazmaps.usgs.gov/

Appendix C.2-1

1. Regional Fault Map
2. Stability Cross Section Location
3. Stability Cross Section
4. SPT N-value Correlations
5. Stability Analysis -- Static
6. Stability Analysis - Seismic

CDM

Appendix C.2-1



FAULT MAP OBTAINED FROM CA DIVISION OF MINES AND GEOLOGY, 1962

NOT TO SCALE

UCG CORP.
PLASTER CITY, CA

REGIONAL FAULT MAP

CDM

FIGURE 1

S:\19921\b4112\01Sheets\ Fig-1FaultPlan-Appndx 02/22/07 14:53 doakec

CDM

Client / Project : USG Plaster City — Project Number : 19921-54112

Subject : Final Cover Stability — Prepared By : JTS — Date : 2/14/07

Comments : — Checked By : JCN — Date : 2/19/07

Sheet : ____ of ____

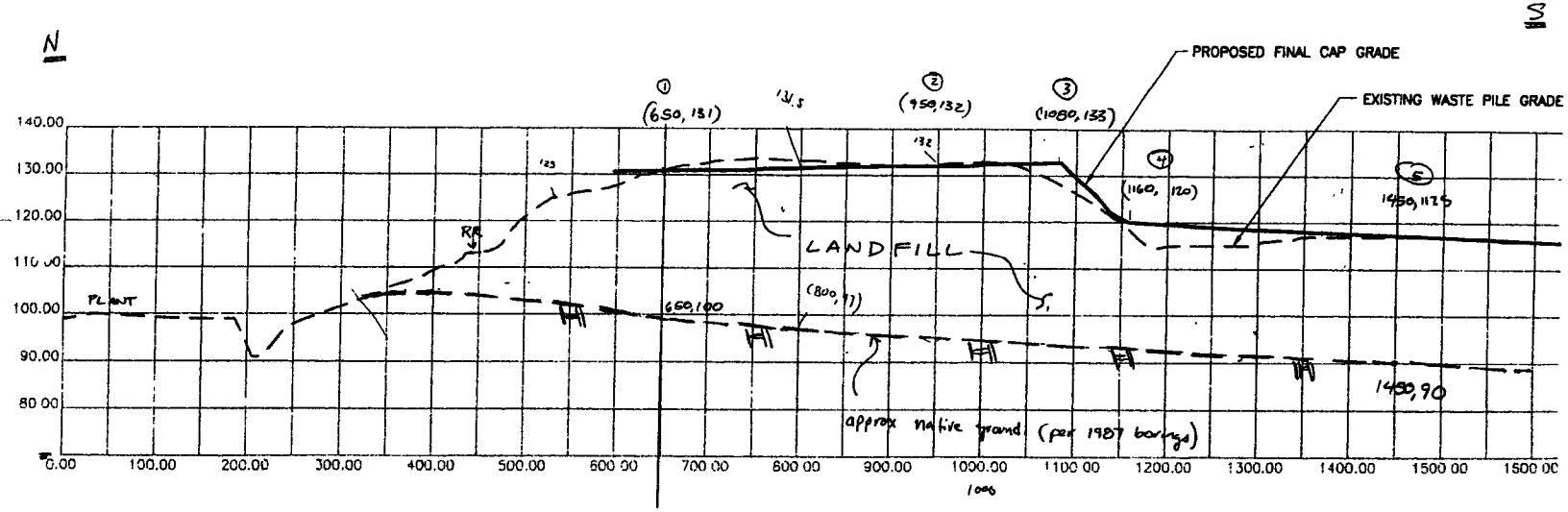


Figure 3

Stability Section

Plaster City Borings
July/Aug 1987

BLOW COUNT CORRECTIONS

Depth		Avg.	OB	Borehole No. / Elev. B-1	B-2	B-3	B-4	B-5	B-6	B-7	B-8	B-9	B-10	Average		Φ (phi) Corellation
				113	113	112	106	116	117	115	106	117	109			
ft	ft	ft	psf*	N	N	N	N	N	N	N	N	N	N	N	Ncorr**	(deg)
2	3.5	2.75	316	25	23	24	~~40~~	~~50~~	14	18	14	23	13	18	***45***	42
7	8.5	7.75	891	57	84	9	37	24	~~50~~	24	8	17	4	14	***21***	37
12	13.5	12.75	1,466	40	86	34	12	82	26	8	22	23	14	16	***19***	36
17	18.5	17.75	2,041	100	100	28	100	40	59	37	40	53	28		***0***	use 35
22	23.5	22.75	2,616	40	100	31	40	100	100	40	65	85	35	64	***56***	
27	28.5	27.75	3,191		100	100	100	47	100	88	40	21	40	71	***56***	
32	33.5	32.75	3,766				100		98	89	91	45	48	79	***57***	use 38 for analysis
37	38.5	37.75	4,341				40			40	85	48	40	51	***34***	
42.5	44	43.25	4,974				84					32		58	***37***	
47	48.5	47.75	5,491				40					40		40	***24***	
52	53.5	52.75	6,066				40					55		48	***27***	

= Bottom of land fill

= Landfill blow counts used for analysis

Figure 4
Landfill Blow Count Correlations

** assumes gamma t =* **115** pcf Groundwater **100** ft

*** corrected for overburden; reference = 2000 psf*

D&M Sample Correction = **0.4** N

2/22/2007 2.38 PM
Blow Count Corrections.xls
JT Souther

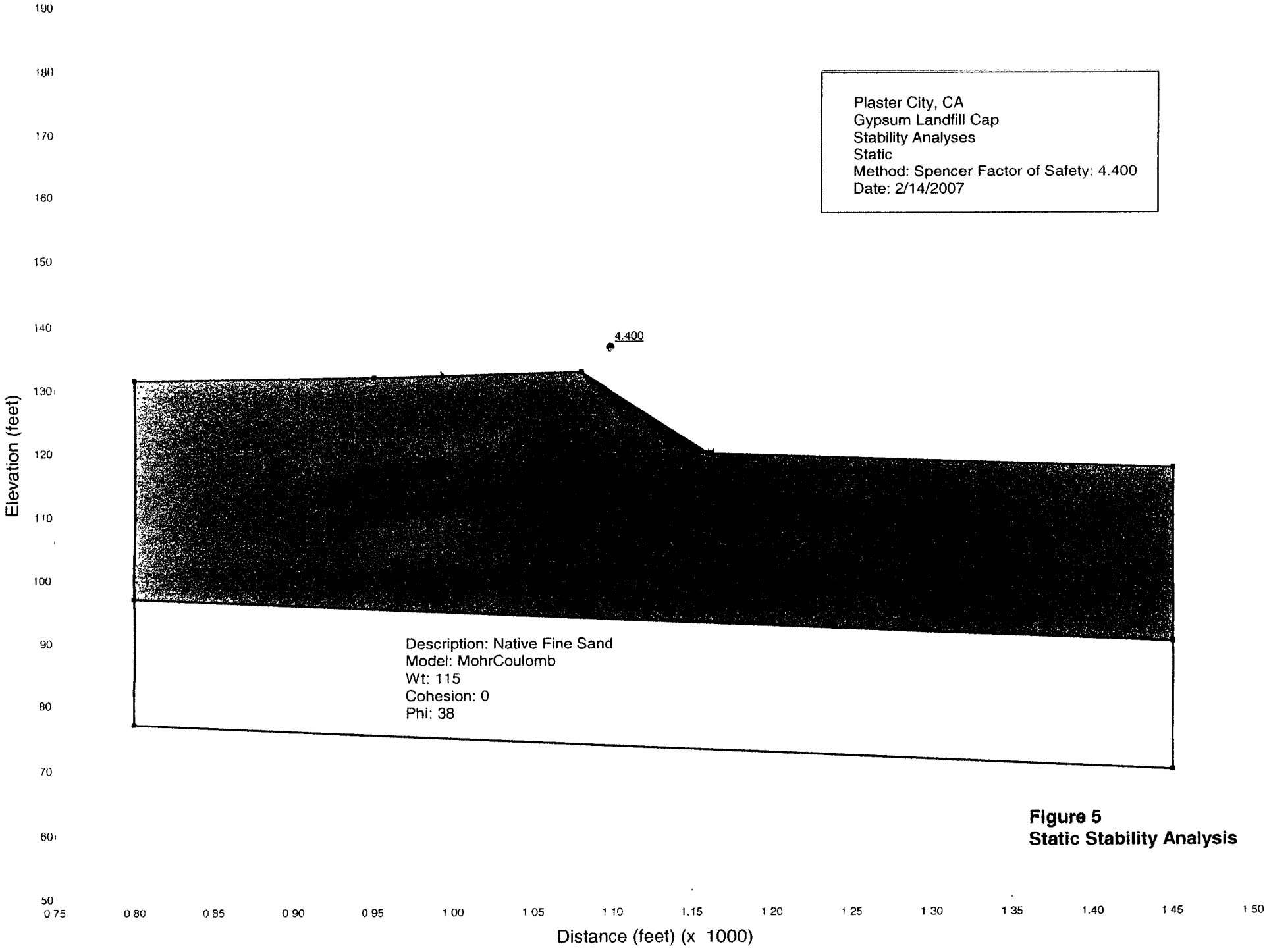


Figure 5
Static Stability Analysis

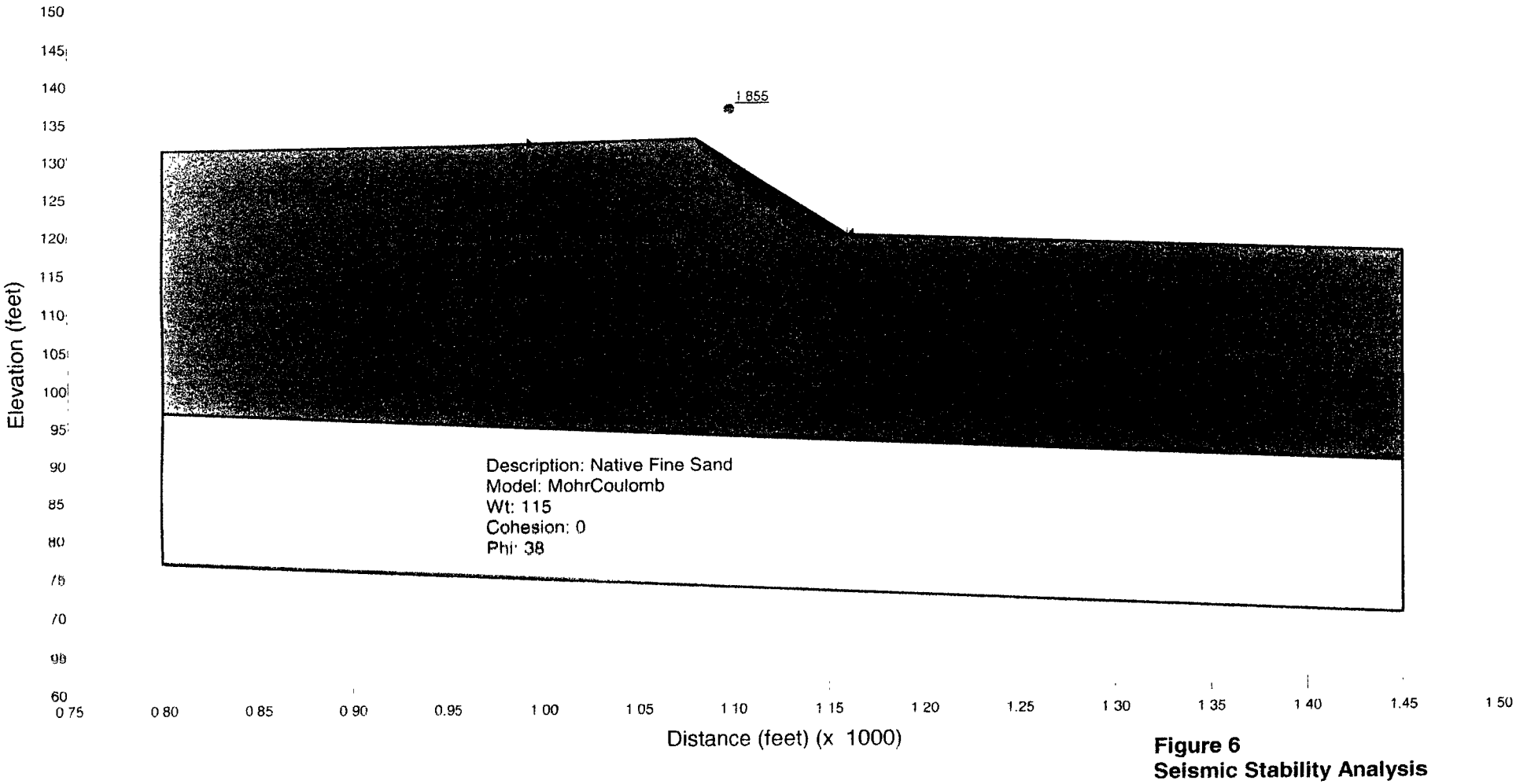


Figure 6
Seismic Stability Analysis

CDM

Geotechnical Engineering Laboratory

Hydraulic Conductivity Using Flexible Wall Permeameter (ASTM D5084)

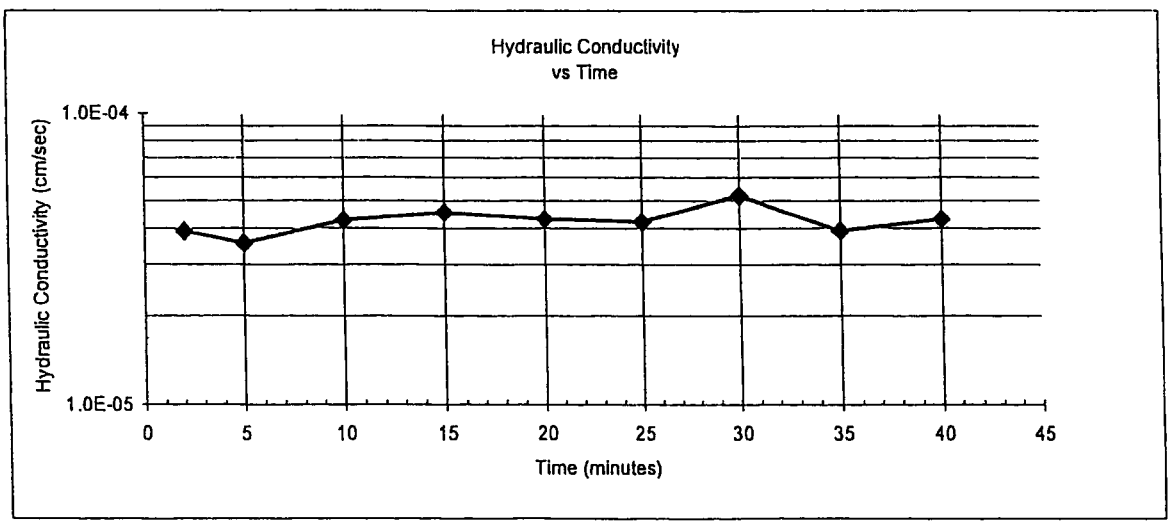
Client:	USG	Tested by:	MAL
Project Name:	Plaster City Waste Pile	Checked by:	JTS
Project Location:	CA	Start Test Date:	10/24/2006
Project Number:	19921-54112	Permeant Fluid:	De-aired water
Sample Number:	Gravelly Sand #1	Sample Preparation Procedures:	Sample compacted to 95% standard Proctor density.
Sample Location:	Gravelly Sand		
Depth (ft):	N/A		
Lab I.D. Number:	N/A		
Sample Description:	Brown gravelly sand, trace silt		
Test Type:	Constant Head (Method A)		

Sample Characteristics	Initial	Final
Avg. length of specimen (in)	6.65	6.65
Avg. dia. of specimen (in)	2.63	2.63
Area (sq in)	5.41	5.44
Volume (cubic in)	35.97	36.21
Moist mass (g)	1224.7	1244.1
Moist unit weight (pcf)	129.7	130.9
Moisture content (%)	9.3	11.1
Dry density (pcf)	118.6	117.9
Specific gravity (assumed)	2.80	2.80
Void ratio	0.47	0.48

Test Specifications	
B-Value (%):	91.0
Consolidation stress (psi):	3.1
Gradient (in/in):	9.6
Cell pressure (psi):	3.1
Head pressure (psi):	2.3
Tail pressure (psi):	0.0
Max effective stress (psi):	3.1
Min effective stress (psi):	0.8

Comments: _____

Hydraulic Conductivity at 20 °C = **4.4E-05** cm/sec



CDM

Geotechnical Engineering Laboratory

Hydraulic Conductivity Using Flexible Wall Permeameter (ASTM D5084)

Client:	USG
Project Name:	Plaster City Waste Pile
Project Location:	CA
Project Number:	19921-54112
Sample Number:	BULK #1
Sample Location:	Silty Sand
Depth (ft):	N/A
Lab I.D. Number:	N/A
Sample Description:	Light brown, silty fine SAND (SM)
Test Type:	Constant Head (Method A)

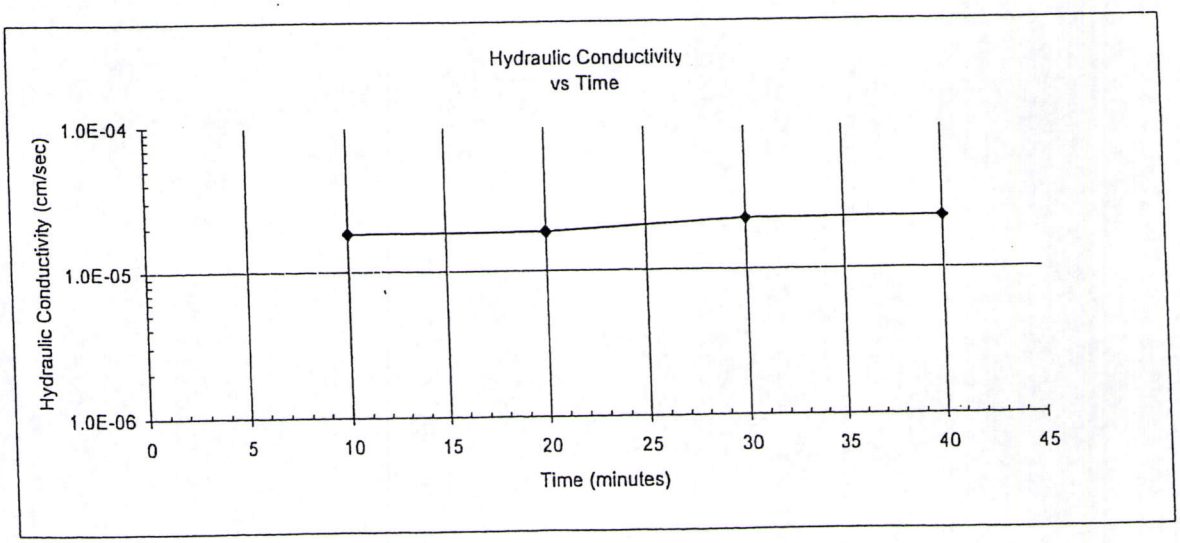
Tested by:	MAL
Checked by:	JTS
Start Test Date:	10/19/2006
Permeant Fluid:	De-aired water
Sample Preparation Procedures:	Sample compacted to 91% standard Proctor density.

Sample Characteristics	Initial	Final
Avg. length of specimen (in)	6.44	6.44
Avg. dia. of specimen (in)	2.64	2.64
Area (sq in)	5.47	5.47
Volume (cubic in)	35.23	35.23
Moist mass (g)	1082.3	1114.6
Moist unit weight (pcf)	117.0	120.5
Moisture content (%)	15.9	19.8
Dry density (pcf)	101.0	100.6
Specific gravity (assumed)	2.70	2.70
Void ratio	0.67	0.68

Test Specifications	
B-Value (%):	NR
Consolidation stress (psi):	7.1
Gradient (in/in):	varied
Cell pressure (psi):	6.3
Head pressure (psi):	varied
Tail pressure (psi):	0.7
Max effective stress (psi):	5.6
Min effective stress (psi):	1.1

Comments: _____

Hydraulic Conductivity at 20 °C = **2.0E-05** cm/sec



CDM

Geotechnical Engineering Laboratory

Hydraulic Conductivity Using Flexible Wall Permeameter (ASTM D5084)

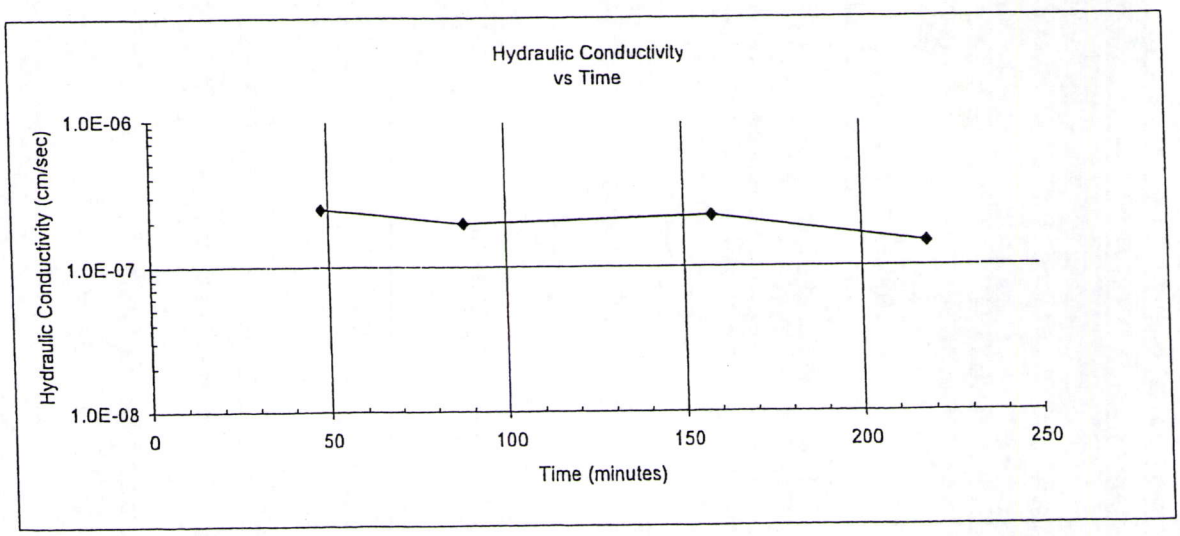
Client:	USG	Tested by:	MAL
Project Name:	Plaster City Waste Pile	Checked by:	JTS
Project Location:	CA	Start Test Date:	10/19/2006
Project Number:	19921-54112	Permeant Fluid:	De-aired water
Sample Number:	Waste #1	Sample Preparation Procedures:	Sample compacted to 88% standard Proctor density.
Sample Location:	Gypsum Waste Pile		
Depth (ft):	N/A		
Lab I.D. Number:	N/A		
Sample Description:	Crushed gypsum wall board		
Test Type:	Constant Head (Method A)		

Sample Characteristics	Initial	Final
Avg. length of specimen (in)	6.65	6.65
Avg. dia. of specimen (in)	2.64	2.64
Area (sq in)	5.47	5.47
Volume (cubic in)	36.38	36.38
Moist mass (g)	655.9	386.5
Moist unit weight (pcf)	68.7	40.5
Moisture content (%)	51.9	91.1
Dry density (pcf)	45.2	21.2
Specific gravity (assumed)	2.80	2.80
Void ratio	2.87	7.25

Test Specifications	
B-Value (%):	NR
Consolidation stress (psi):	40.0
Gradient (in/in):	83.7
Cell pressure (psi):	40.0
Head pressure (psi):	30.1
Tail pressure (psi):	10.0
Max effective stress (psi):	30.0
Min effective stress (psi):	9.9

Comments: Some large voids in sample due to compacting method.

Hydraulic Conductivity at 20 °C = **2.0E-07** cm/sec



Wash 200(ASTM D-1140)

*enter gray boxes only

*assumes same sample and tare for wash and sieve

Project Name: USG Corp Plaster City

Project Number: 1992-54112*Borrow

Sample ID: [redacted]roctor

Date: 10/18/06

Performed By: MKM

Date Reviewed: 19-Oct

Reviewed By: JTS

Tare #:	
Tare Wt.	
Wt. Of Wet + Tare	
Wt. Of Dry + Tare(before wash)	
Wt. Of Water	
Wt. Of Dry	
Nat. Moisture Content	

Wt of Dry (after wash)-Tare	
Tare Wt	
Wt Of Dry + Tare (before wash)	
Wt of Dry + Tare (after wash)	
Wt from wash	
Wt of Dry (before wash)	
% -200 from wash	

Paper left in pan.

Gypsum After Proctor

Results

Natural Moisture Content	% -200 From Wash
21.0	96.98

LAB USE ONLY

	YES	NO
DID YOU GET TH DRY WEIGHT?		
WAS THIS SAMPLE WASHED?		
IS THE SAMPLE COMPLETE?		

Grain Size Analysis Calculation Check(ASTM D-422/D-1140)

*assumes same sample and tare for wash and sieve

Project Name: USG Corp
Project Number: 19921-54112-BORROW

Sample ID: Test Pit Gravelly Sand
Date: 10/23/06
MKM

Date Reviewed: 10/24/06
Reviewed By: JTS

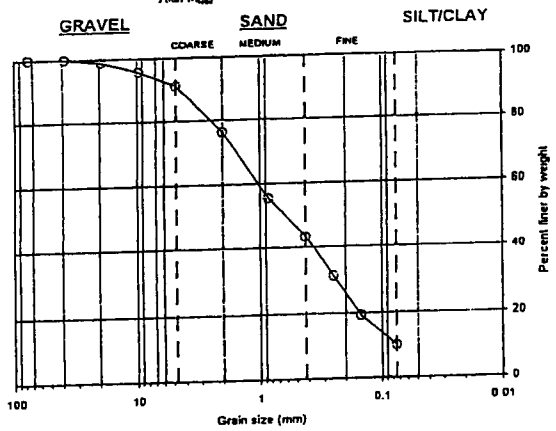
Tare #:	C3
Tare Wt.	211.08
Wt. Of Wet + Tare	1523.37
Wt. Of Dry + Tare(before wash)	1510.25
Wt. Of Water	13.12
Wt. Of Dry	1299.17
Nat. Moisture Content	1.0

Wt of Dry (after wash)-Tare	1171.04
Tare Wt	211.08
Wt. Of Dry – Tare (before wash)	1510.25
Wt of Dry + Tare (after wash)	1382.12
Wt from wash	128.13
Wt of Dry (before wash)	1299.17
% -200 from wash	9.86

LAB USE ONLY	YES	NO
DID YOU GET THE DRY WEIGHT?	X	
WAS THIS SAMPLE WASHED?		X
IS THE SAMPLE COMPLETE?	X	

Sieve Opening (mm)	Sieve Size	Accumulative Mass Retained (g)	Mass Passing (g)	Percent Finer By Weight
76.200	3"		1299.79	100.00
38.100	1.5"		1299.79	100.00
19.050	3/4"	14.09	1285.70	98.92
9.525	3/8"	55.39	1244.40	95.74
4.750	#4	116.62	1183.17	91.02
2.000	#10	309.34	990.45	76.19
0.850	#20	579.02	720.77	55.43
0.425	#40	754.41	565.38	43.47
0.250	#60	891.75	408.04	31.36
0.150	#100	1047.85	251.94	19.34
0.075	#200	1168.92	130.87	10.03
	pan	1171.66	128.13	
	Total M_{wet}	1299.79		

Grain Size Delineation			
	GRAVEL		
COARSE		% Gravel (Coarse)	0.00%
FINE		% Gravel (Fine)	8.98%
	SAND		
COARSE		% Sand (Coarse)	14.83%
MEDIUM		% Sand (Medium)	32.72%
FINE		% Sand (Fine)	33.45%
	SILT/CLAY	% Fines	10.03%



RESULTS

Sample ID:	Test Pit Gravelly Sand
Field Logged USCS=	SW
Lab USCS=	SP-SM
Nat.Moisture Content(%)=	1.0
D_{10}=	0.070 mm
D_{30}=	0.235 mm
D_{60}=	1.024 mm
$C_c=(D_{30})^2/(D_{10}*D_{60})$=	0.773
$C_u=(D_{60}/D_{10})$=	14.630

Sieve (d')

Grain Size Analysis Calculation Check (ASTM D 422/D 1140)

*assumes same sample and tare for wash and sieve

Project Name: USG Corp
Project Number: 19921-54112-BORROW

Sample ID: Test Pit Gypsum
Date: 10/16/06
MKM

Date Reviewed: 10/17/06
Reviewed By: JTS

NOTE
Performed sieve without wash to determine how the material would break down.

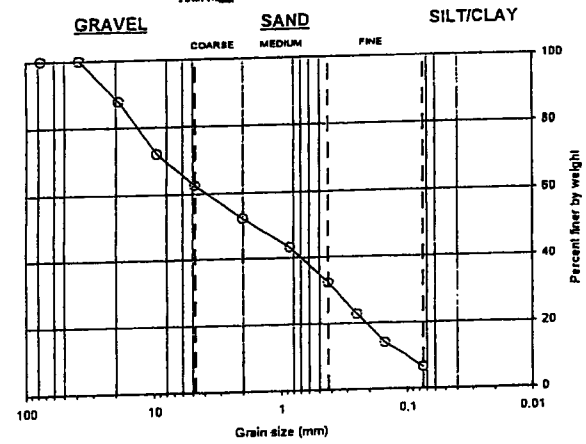
Tare #.	1
Tare Wt	237.36
Wt Of Wet + Tare	
Wt. Of Dry + Tare(before wash)	1054.14
Wt. Of Water	0
Wt. Of Dry	816.78
Nat. Moisture Content	N/A

Wt of Dry (after wash)-Tare	0
Tare Wt.	0
Wt. Of Dry + Tare (before wash)	0
Wt of Dry + Tare (after wash)	1054.14
Wt from wash	0
Wt of Dry (before wash)	1054.14
% -200 from wash	N/A

LAB USE ONLY	YES	NO
DID YOU GET THE DRY WEIGHT?	X	
WAS THIS SAMPLE WASHED?		X
IS THE SAMPLE COMPLETE?	X	

Sieve Opening (mm)	Sieve Size	Accumulative Mass Retained (g)	Mass Passing (g)	Percent Finer By Weight
76.200	3"		816.12	100.00
38.100	1.5"		816.12	100.00
19.050	3/4"	99.80	716.32	87.78
9.525	3/8"	228.89	587.23	71.98
4.750	#4	306.95	509.17	62.42
2.000	#10	389.79	426.33	52.26
0.850	#20	464.29	351.83	43.16
0.425	#40	552.21	263.91	32.39
0.250	#60	630.57	185.55	22.80
0.150	#100	701.85	114.27	14.07
0.075	#200	763.97	52.15	6.47
	pan	816.12	0.00	
	Total M_{wet}	816.12		

Grain Size Delineation			
COARSE GRAIN	GRAVEL	% Gravel (Coarse)	0.00%
FINE GRAIN		% Gravel (Fine)	37.58%
COARSE GRAIN	SAND	% Sand (Coarse)	10.14%
MEDIUM GRAIN		% Sand (Medium)	19.89%
FINE GRAIN		% Sand (Fine)	25.93%
	SILT/CLAY	% Fines	6.47%



RESULTS

Sample ID:	Test Pit Gypsum
Field Logged USCS=	SP-SM
Lab USCS=	SP
Nat.Moisture Content(%)=	N/A
D_{10}=	0.136 mm
D_{30}=	0.642 mm
D_{60}=	12.145 mm
$C_c=(D_{30})^2/(D_{10}*D_{60})$=	0.250
$C_u=(D_{60}/D_{10})$=	89.376

Grain Size Analysis Calculation Check (ASTM D 422/D 1140)

*assumes same sample and tare for wash and sieve

Project Name: USG Corp
Project Number: 19921-54112-BORROW

Sample ID: Test Pit Silty Sand
Date: 10/16/06
MKM

Date Reviewed: 10/17/06
Reviewed By: JTS

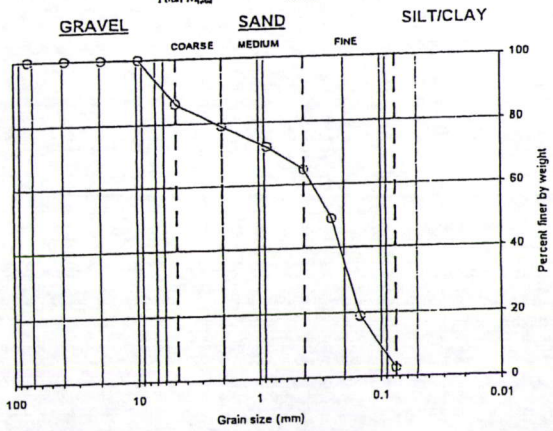
Tare #:	D60
Tare Wt.	106.28
Wt. Of Wet + Tare	335.06
Wt. Of Dry + Tare(before wash)	316.1
Wt. Of Water	18.96
Wt. Of Dry	209.82
Nat. Moisture Content	9.0

Wt of Dry (after wash)-Tare	209.82
Tare Wt.	106.28
Wt. Of Dry – Tare (before wash)	316.1
Wt of Dry + Tare (after wash)	316.1
Wt from wash	0
Wt of Dry (before wash)	209.82
% -200 from wash	0.00

LAB USE ONLY	YES	NO
DID YOU GET THE DRY WEIGHT?	X	
WAS THIS SAMPLE WASHED?		X
IS THE SAMPLE COMPLETE?	X	

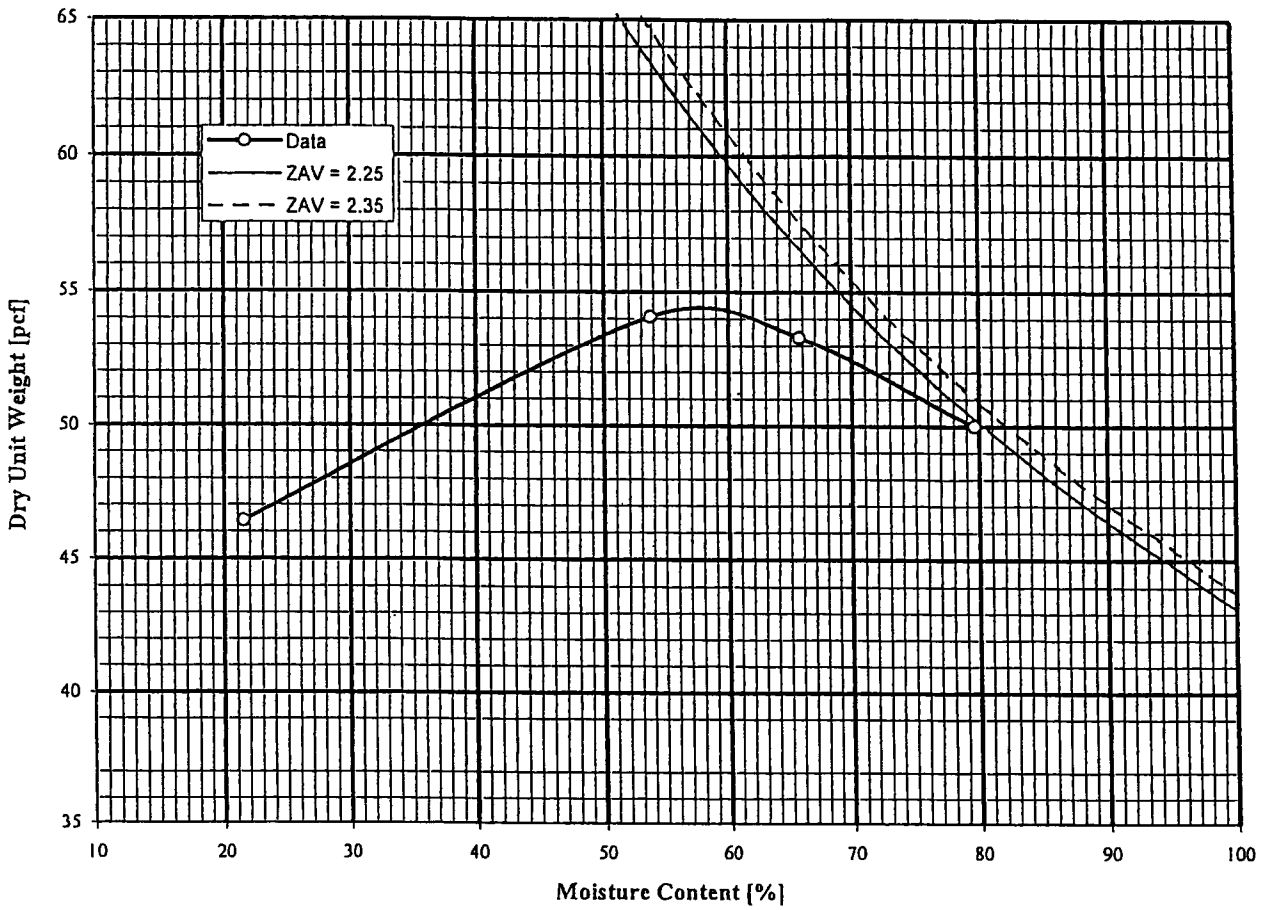
Sieve Opening (mm)	Sieve Size	Accumulative Mass Retained (g)	Mass Passing (g)	Percent Finer By Weight
76.200	3"		209.65	100.00
38.100	1.5"		209.65	100.00
19.050	3/4"		209.65	100.00
9.525	3/8"		209.65	100.00
4.750	#4	28.90	180.75	86.23
2.000	#10	44.21	165.44	78.93
0.850	#20	58.33	151.32	72.20
0.425	#40	74.04	135.61	64.71
0.250	#60	106.77	102.88	49.11
0.150	#100	170.19	39.46	18.89
0.075	#200	204.23	5.42	2.66
	pan	209.65	0.00	
	Total M_{wet}	209.65		

Grain Size Delineation			
COARSE GRAIN	GRAVEL	% Gravel (Coarse)	0.00%
FINE GRAIN		% Gravel (Fine)	13.77%
COARSE GRAIN	SAND	% Sand (Coarse)	7.30%
MEDIUM GRAIN		% Sand (Medium)	14.22%
FINE GRAIN		% Sand (Fine)	62.05%
	SILT/CLAY	% Fines	2.66%



RESULTS

Sample ID:	Test Pit Silty Sand
Field Logged USCS=	SW
Lab USCS=	SP
Nat.Moisture Content(%)=	9.0
D_{10}=	0.103 mm
D_{30}=	0.181 mm
D_{60}=	0.363 mm
$C_c=(D_{30})^2/(D_{10}*D_{60})$=	0.879
$C_u=(D_{60}/D_{10})$=	3.526

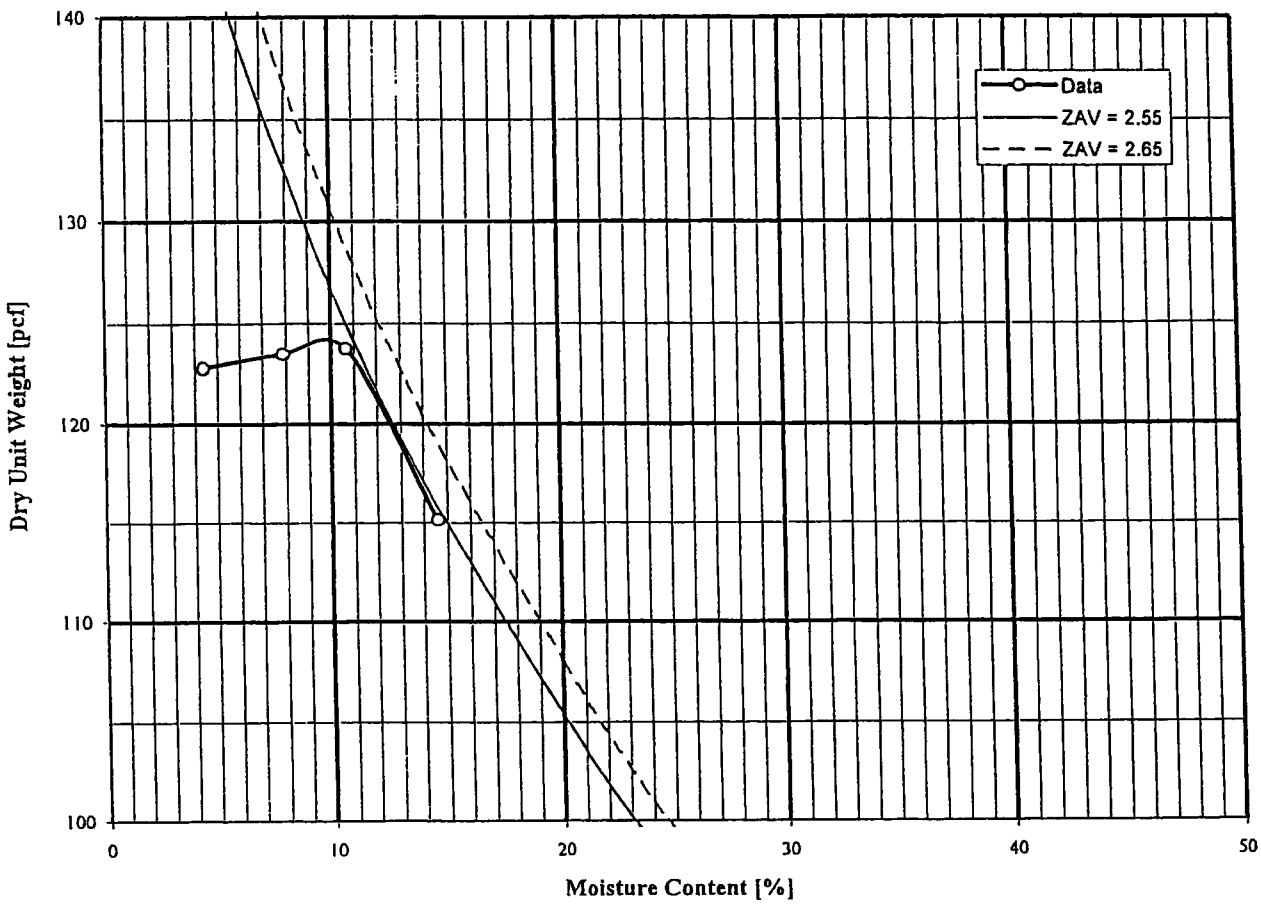


Exploration No:	Gypsum Test Pits	**Max Dry Unit Weight [pcf]:**	54.5
Sample No:	Bucket	**Optimum Moisture Content [%]:**	57.5
Depth (ft):	Grab		
Sample Date:	__/__/2006	**Mold Size:**	4 inch
As Rec'd Moisture:	21.5%		

Testing Comments

N/A

CDM **Geotechnical Engineering Laboratory**	**Client:** USG Corp **Project:** Plaster City Wastepile **Project No:** 19921-54112-Borrow	**Compaction Test** **ASTM D698** Figure 5

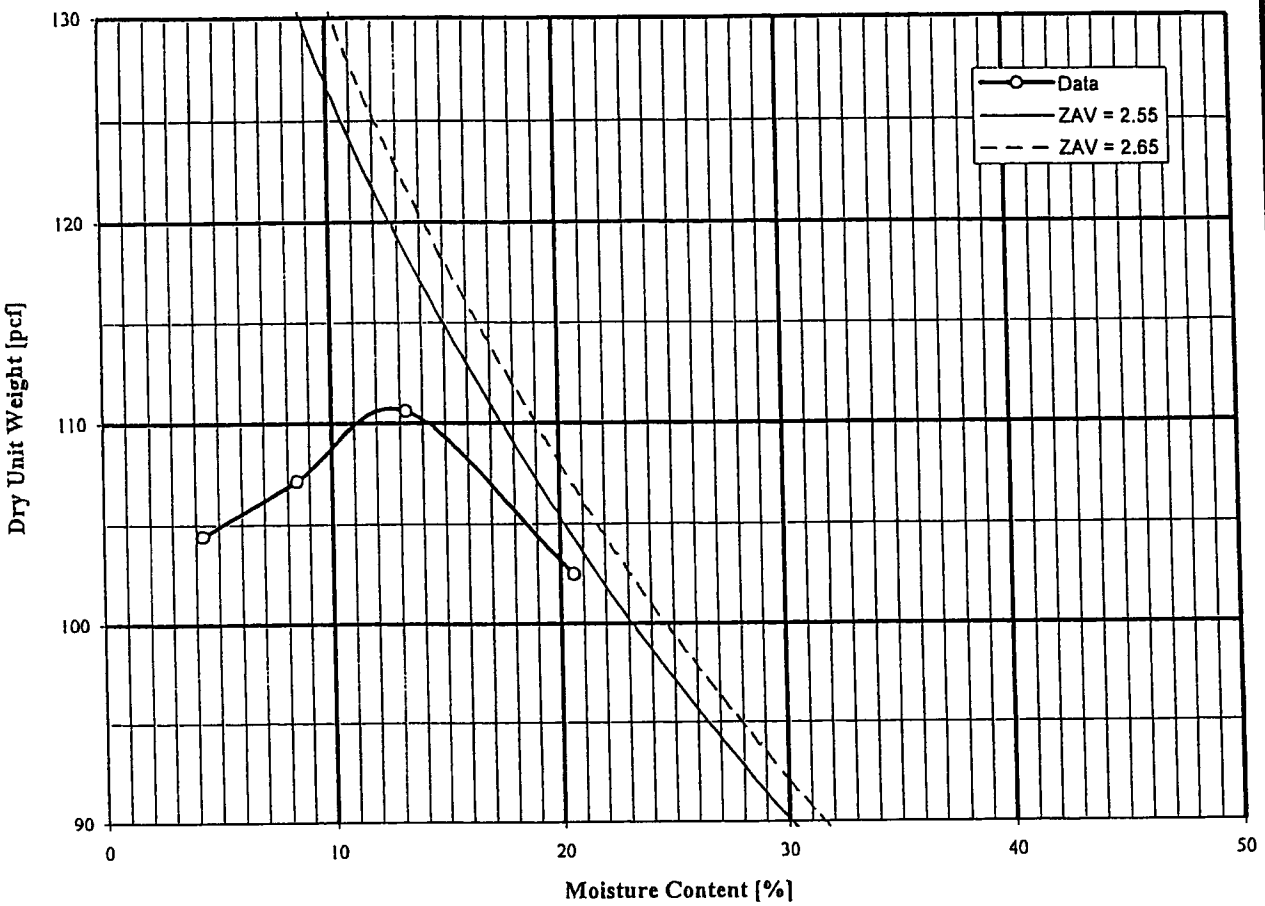


Exploration No:	Gravelly/Sand Test Pits	**Max Dry Unit Weight [pcf]:**	124.7
Sample No:	Bucket	**Optimum Moisture Content [%]:**	9.7
Depth (ft):	Grab		
Sample Date:	__/__/2006	**Mold Size:**	4 inch
As Rec'd Moisture:	0.9%		

Testing Comments

Insufficient sample to complete 5th point.

CDM **Geotechnical Engineering Laboratory**	**Client:** USG Corp **Project:** Plaster City Wastepile **Project No:** 19921-54112-Borrow	**Compaction Test** **ASTM D698** Figure 5



Exploration No:	Silty/Sand Test Pits	**Max Dry Unit Weight [pcf]:**	111.0
Sample No:	Bucket	**Optimum Moisture Content [%]:**	12.6
Depth (ft):	Grab		
Sample Date:	__/__/2006	**Mold Size:**	4 inch
As Rec'd Moisture:	5.0%		

Testing Comments

Insufficient sample to complete 5th point.

CDM **Geotechnical Engineering Laboratory**	**Client:** USG Corp **Project:** Plaster City Wastepile **Project No:** 19921-54112-Borrow	**Compaction Test** **ASTM D698** Figure 5

SOIL CLASSIFICATION LEGEND

MAJOR DIVISIONS				TYPICAL NAMES
COARSE GRAINED SOILS More than half is larger than No. 200 sieve	GRAVELS More than half coarse fraction is larger than No. 4 sieve size	Clean gravels with little or no fines	GW	Well graded gravels, gravel-sand mixtures
			GP	Poorly graded gravels, gravel-sand mixtures
		Gravel with over 12% fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS More than half coarse fraction is smaller than No. 4 sieve size	Clean sands with little or no fines	SW	Well graded sands, gravelly sands
			SP	Poorly graded sands, gravelly sands
		Sands with over 12% fines	SM	Silty sand, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS More than half is smaller than No. 200 sieve	SILTS AND CLAYS Liquid limit less than 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic clays and organic silty clays of low plasticity
	SILTS AND CLAYS Liquid limit greater than 50		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils

SAMPLE TYPE SYMBOLS

- Disturbed bag or jar sample
- Std. Penetration Test (2.0" OD)
- Type U Ring Sampler (3.25" OD)
- California Sampler (3.0" OD)
- Undisturbed Tube Sample
- Grab Sample
- Core Run
- Non-standard Penetration Test (with split spoon sampler)
- Bulk Sample

CONTACT BETWEEN UNITS

- Change in geologic unit
- Soil type change within geologic unit
- Obscure or gradational change

DESCRIPTORS FOR SOIL STRATA AND STRUCTURE (ENGLISH/METRIC)

General Thickness or Spacing		Structure		General Attitude	
Parting:	less than 1/16 in. (1/6 cm)	Pocket:	Erratic, discontinous deposit of limited extent	Near horizontal:	0 to 10 deg.
Seam:	1/16 to 1/2 in. (1/6 to 1 1/4 cm)	Lens:	Lenticular deposit	Low angle:	10 to 45 deg.
Layer:	1/2 to 12 in. (1 1/4 to 30 1/2 cm)	Varved:	Alternating seams of silt and clay	High angle:	45 to 80 deg.
Stratum:	> 12 in. (30 1/2 cm)	Laminated:	Alternating seams	Near Vertical:	80 to 90 deg.
Scattered:	< 1 per ft. (30 1/2 cm)	Interbedded:	Alternating layers		
Numerous:	> 1 per ft. (30 1/2 cm)				

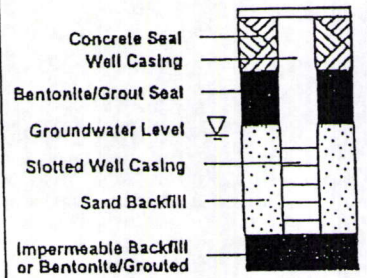
MOISTURE DESCRIPTION

- Dry - Free of moisture, dusty
- Moist - Damp but no visible free water
- Wet - Visible free water, saturated

STRUCTURE DESCRIPTION (cont.)

Fractured	Breaks easily along definite fractured planes
Slickensided	Polished, glossy, fractured planes
Blocky, Diced	Breaks easily into small angular lumps
Sheared	Disturbed texture, mix of strengths
Homogenous	Same color and appearance throughout

WELL COMPLETIONS



RELATIVE DENSITY OR CONSISTENCY VS. SPT N-VALUE

COARSE GRAINED			FINE GRAINED		
Density	N (blows/ft)	Approx. Relative Density (%)	Consistency	N (blows/ft)	Approx. Undrained Shear Str. (psf)
Very Loose	0 to 4	0 - 15	Very Soft	0 to 2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	35 - 65	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	Over 50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	over 30	>4000

PHYSICAL PROPERTY TEST

AL -	Atterberg Limits
FC -	Fines Content
GSD -	Grain Size Distribution
MC -	Moisture Content
MD -	Moisture Content/Dry Density
Comp -	Compaction Test (Proctor)
SG -	Specific Gravity
CBR -	California Bearing Ratio
RM -	Resilient Modulus
Perm -	Permeability
TXP -	Triaxial Permeability
Cons -	Consolidation
Chem -	Analytical Chemical Analysis
Corr -	Corrosion
VS -	Vane Shear
DS -	Direct Shear
UC -	Unconfined Compression
TX -	Triaxial Compression
UU -	Unconsolidated, Undrained
CU -	Consolidated, Undrained
CD -	Consolidated, Drained

Notes:

1. Sample descriptions in this report are based on visual field and laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates, and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual classification methods in accordance with ASTM D 2488 were used as an identification guide. Where laboratory data are available, soil classifications are in general accordance with ASTM D 2487.

2. Dual symbols are used to indicate gravel and sand units with 5 to 12 percent fines.

3. WOR = weight of rod.

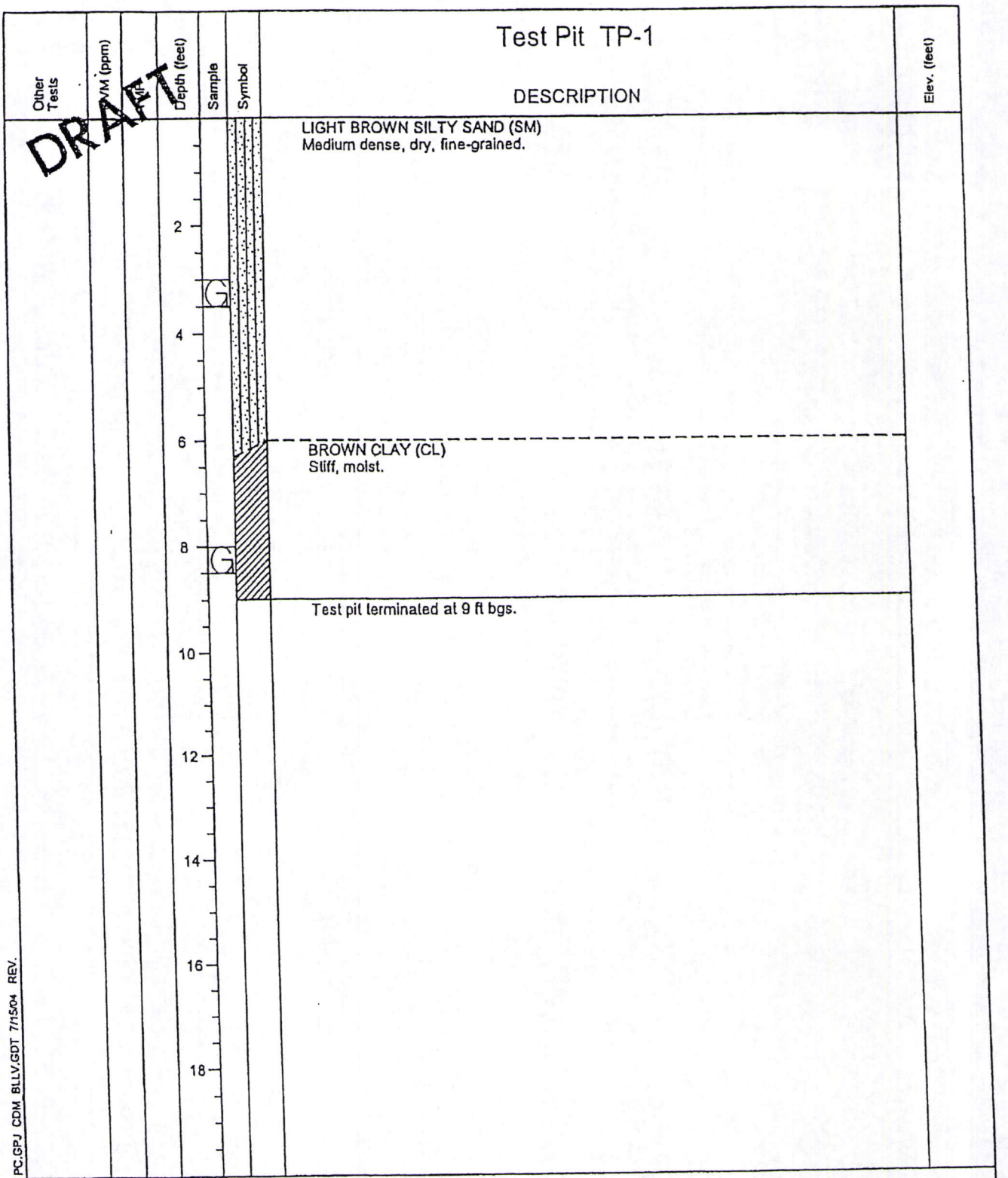
USG
Plaster City
Plaster City, California

Project No: 19921.38072 Figure: A-1

CDM

SOIL CLASSIFICATION/LEGEND USG 38072 PC.GPJ CDM_BLLV.GDT 7/15/04 REV.

Test Pit TP-1



Location: See Site Plan
Surface Elevation:

Date Completed: 6-29-04
Logged By: CJL

USG
Plaster City
Plaster City, California

CDM

Test Pit TP-1
Project No: 19921.38072

Figure: A-2
1 of 1

TEST_PIT_TEMP USG 38072 PC.GPJ CDM BLLV.GDT 7/15/04 REV.

Test Pit TP-2

DRAFT

Other Tests	VOM (ppm)	TMP	Depth (feet)	Sample	Symbol	DESCRIPTION	Elev. (feet)
			0			LIGHT BROWN SILTY SAND (SM) Medium dense, dry, fine-grained.	
			2	G		Becomes dense, slightly cemented.	
			4			Becomes yellowish-brown/rusty.	
			6			Becomes light brown.	
			8				
			10			Becomes dense.	
			12				
			14			Test pit terminated at 14 bgs.	
			16				
			18				

Location: See Site Plan
Surface Elevation:

Date Completed: 6-29-04
Logged By: CJL

USG
Plaster City
Plaster City, California

CDM

Test Pit TP-2
Project No: 19921.38072

Figure: A-3
1 of 1

TEST_PIT_TEMP_USG 38072 PC.GPJ CDM_BLLV.GDT 7/22/04 REV.

DRAFT

Test Pit TP-3

Other Tests	OVM (ppm)	TMP	Depth (feet)	Sample	Symbol	DESCRIPTION	Elev. (feet)
			2	G		BROWNISH YELLOW GRAVELLY SAND (SW) Medium dense, dry, fine- to coarse-grained, fine-grained gravel, with trace silt.	
			4			LIGHT BROWN SILTY SAND (SM) Dense, dry, fine-grained, slightly cemented.	
			8				
			10	G		DARK BROWN CLAY (CL) Stiff, moist.	
			12				
			14			Test pit terminated at 13 ft bgs.	
			16				
			18				

Location: See Site Plan
Surface Elevation:

Date Completed: 6-29-04
Logged By: CJL

CDM

USG
Plaster City
Plaster City, California

Test Pit TP-3
Project No: 19921.38072

Figure: A-4
1 of 1

TEST PIT TEMP USG 38072.PC.GPJ CDM_BLLV.GDT 7/15/04 REV.

Test Pit TP-4

DRAFT

Other Tests	OVM (ppm)	PID	Depth (feet)	Sample	Symbol	DESCRIPTION	Elev. (feet)
			0			BROWNISH YELLOW GRAVELLY SAND (SW) Medium dense, dry, fine- to coarse-grained, fine-grained gravel.	
			2				
			4			LIGHT BROWN SILTY SAND (SM) Medium dense, dry, fine-grained.	
			6				
			8				
			10				
			12			DARK BROWN CLAY (CL) Stiff, moist.	
			14			Test pit terminated at 14 ft bgs.	
			16				
			18				

Location: See Site Plan
Surface Elevation:

Date Completed: 6-29-04
Logged By: CJL

CDM

USG
Plaster City
Plaster City, California

Test Pit TP-4
Project No: 19921.38072

Figure: A-5
1 of 1

TEST_PIT_TEMP USG 38072 PC.GPJ CDM_BLLV.GDT 7/15/04 REV.

Test Pit TP-5

DRAFT

Other Tests	OVM (ppm)	TVP	Depth (feet)	Sample	Symbol	DESCRIPTION	Elev. (feet)
			0			LIGHT BROWN SILTY SAND (SM) Medium dense, dry, fine- to medium-grained, with trace fine-grained gravel.	
			2	G			
			4			Becomes fine-grained with no gravel.	
			6				
			8			DARK BROWN CLAY (CL) Stiff, moist.	
			10				
			12			Test pit teminated at 13 ft bgs.	
			14				
			16				
			18				

Location: See Site Plan
Surface Elevation:

Date Completed: 6-29-04
Logged By: CJL

USG
Plaster City
Plaster City, California

CDM

Test Pit TP-5
Project No: 19921.38072

Figure: A-6
1 of 1

TEST PIT TEMP USG 38072 PC.GPJ CDM BLLV.GDT 7/22/04 REV.

Test Pit TP-6

DRAFT

Other Tests	Vapor (ppm)	Time	Depth (feet)	Sample	Symbol	DESCRIPTION	Elev. (feet)
			0			LIGHT BROWN GRAVELLY SAND (SW) Medium dense, dry, fine- to coarse-grained, fine-grained gravel, interbedded with brown clay, medium stiff, moist.	
			2				
			4	G		DARK BROWN CLAY (CL) Stiff, moist.	
			6				
			8				
			10			LIGHT BROWN SILTY SAND (SM) Dense, dry, fine-grained, slightly cemented.	
			12				
			14			Test pit terminated at 13 ft bgs.	
			16				
			18				

Location: See Site Plan
Surface Elevation:

Date Completed: 6-29-04
Logged By: CJL

CDM

USG
Plaster City
Plaster City, California

Test Pit TP-6
Project No: 19921.38072

Figure: A-7
1 of 1

TEST PIT TEMP USG 38072 PC.GPJ CDM_BLLV.GDT 7/22/04 REV.

DRAFT

Test Pit TP-7

Depth (feet)	Sample	Symbol	DESCRIPTION	Elev. (feet)
2	G		BROWNISH YELLOW GRAVELLY SAND (SW) Medium dense, dry, fine- to coarse-grained, fine-grained gravel.	
			BROWN CLAY (CL) Stiff, moist.	
4			LIGHT BROWN SILTY SAND (SM) Dense, dry, fine-grained, slightly cemented.	
6				
8				
10				
12				
			Test pit terminated at 13 ft bgs.	
14				
16				
18				

Location: See Site Plan
Surface Elevation:

Date Completed: 6-29-04
Logged By: CJL

CDM

USG
Plaster City
Plaster City, California

Test Pit TP-7
Project No: 19921.38072

Figure: A-8
1 of 1

TEST_PIT_TEMP USG 38072 PC.GPJ CDM BLLV.GDT 7/15/04 REV.

DRAFT

Test Pit TP-8

Water Level	OVA (ppm)	TMP	Depth (feet)	Sample	Symbol	DESCRIPTION	Elev. (feet)
			2	G		BROWNISH YELLOW SAND (SW) Loose, dry, fine- to coarse-grained, with trace fine gravel.	
			4			LIGHT BROWN SILTY SAND (SM) Medium dense, dry, fine-grained, slightly cemented.	
			6				
			8				
			10				
			12				
			14			Test pit terminated at 13 ft bgs.	
			16				
			18				

Location: See Site Plan
Surface Elevation:

Date Completed: 6-30-04
Logged By: CJL

CDM

USG
Plaster City
Plaster City, California

Test Pit TP-8
Project No: 19921.38072

Figure: A-9
1 of 1

TEST_PIT_TEMP USG 38072 PC.GPJ CDM_BLLV.GDT 7/15/04 REV.

DRAFT

Test Pit TP-9

Depth (feet)	Sample	Symbol	DESCRIPTION	Elev. (feet)
0			BROWNISH YELLOW SAND (SW) Loose, dry, fine- to coarse-grained, with trace gravel.	
4			LIGHT BROWN SILTY SAND (SM) Dense, dry, fine-grained, slightly cemented.	
13			Test pit terminated at 13 ft bgs.	

OVA (ppm)

TMP

Location: See Site Plan

Surface Elevation:

Date Completed: 6-30-04

Logged By: CJL

CDM

USG
Plaster City
Plaster City, California

Test Pit TP-9

Project No: 19921.38072

Figure: A-10

1 of 1

TEST_PIT_TEMP USG 38072 PC.GPJ CDM_BLLV.GDT 7/15/04 REV.

DRAFT

Test Pit TP-10

Other Tests	OVM (ppm)	TMP	Depth (feet)	Sample	Symbol	DESCRIPTION	Elev. (feet)
			0			LIGHT BROWN SILTY SAND (SM) Loose, dry, fine- to medium-grained.	
			2			Becomes dense, fine-grained.	
			4				
			6	G			
			8				
			10				
			12			DARK BROWN CLAY (CL) Very stiff, moist.	
						Test pit terminated at 13 ft bgs.	
			14				
			16				
			18				

Location: See Site Plan
Surface Elevation:

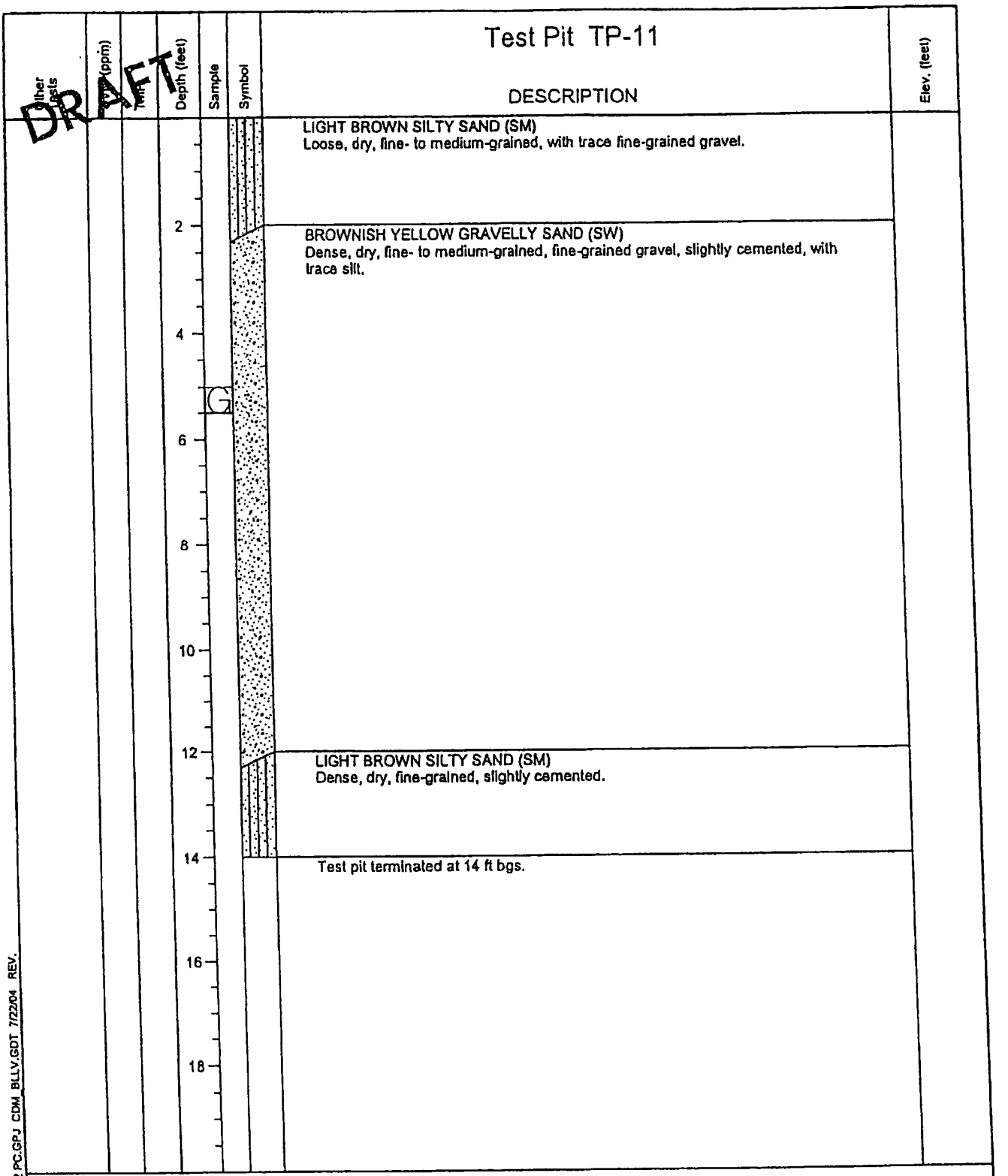
Date Completed: 6-30-04
Logged By: CJL

CDM

USG
Plaster City
Plaster City, California

Test Pit TP-10 Figure: A-11
Project No: 19921.38072 1 of 1

TEST_PIT_TEMP_USG 38072 PC.GPJ CDM_BLLV.GDT 7/15/04 REV.



Location: See Site Plan
Surface Elevation:

Date Completed: 6-30-04
Logged By: CJL

TEST_PIT_TEMP USG 38072 PC.GPJ CDM_BLLV.GDT 7/22/04 REV.

CDM

USG
Plaster City
Plaster City, California

Test Pit TP-11
Project No: 19921.38072

Figure: A-12
1 of 1

DRAFT

Test Pit TP-12

Other Tests	OVA (ppm)	TMP	Depth (feet)	Sample	Symbol	DESCRIPTION	Elev. (feet)
			0			LIGHT BROWN SILTY SAND (SM) Medium dense, dry, fine-grained, slightly cemented.	
			2	G			
			4			Becomes dense.	
			6				
			8				
			10			Becomes medium dense.	
			12			Test pit terminated at 12 ft bgs.	
			14				
			16				
			18				

Location: See Site Plan
Surface Elevation:

Date Completed: 6-30-04
Logged By: CJL

USG
Plaster City
Plaster City, California

CDM

Test Pit TP-12
Project No: 19921.38072

Figure: A-13
1 of 1

TEST_PIT_TEMP USG 38072 PC.GPJ CDM_BLLV.GDT 7/15/04 REV.

DRAFT

Test Pit TP-13

Depth (feet)	Sample	Symbol	DESCRIPTION	Elev. (feet)
0			BROWNISH YELLOW GRAVELLY SAND (SW) Medium dense, dry, fine- to coarse-grained, fine- to coarse-grained gravel.	
2				
4			Becomes dense.	
6				
8				
10			DARK BROWN CLAY (CL) Stiff, moist.	
12			Test pit terminated at 12 ft bgs.	
14				
16				
18				

Location: See Site Plan
Surface Elevation:

Date Completed: 6-30-04
Logged By: CJL

CDM

USG
Plaster City
Plaster City, California

Test Pit TP-13 Figure: A-14
Project No: 19921.38072 1 of 1

TEST_PIT_TEMP USG 38072 PC.GPJ CDM_BLLV.GDT 7/15/04 REV.

Test Pit TP-14

DRAFT

Other Tests	VOA (ppm)	TMP	Depth (feet)	Sample	Symbol	DESCRIPTION	Elev. (feet)
			0			BROWNISH YELLOW GRAVELLY SAND (SW) Dense, dry, fine- to coarse-grained, fine-grained gravel.	
			2				
			4				
			6				
			8			With trace cobbles.	
			10				
			12				
			13			Test pit terminated at 13 ft bgs.	
			14				
			16				
			18				

Location: See Site Plan
Surface Elevation:

Date Completed: 6-30-04
Logged By: CJL

USG
Plaster City
Plaster City, California

CDM

Test Pit TP-14 Figure: A-15
Project No: 19921.38072 1 of 1

TEST_PIT_TEMP USG 38072 PC.GPJ CDM_BLLV.GDT 7/15/04 REV.

DRAFT

Test Pit TP-15

Other Tests	PID (ppm)	Depth (feet)	Sample	Symbol	DESCRIPTION	Elev. (feet)
		0			BROWNISH YELLOW GRAVELLY SAND (SW) Medium dense, dry, fine- to coarse-grained, fine-grained gravel.	
		2				
		4				
		6				
		8				
		10			LIGHT BROWN SILTY SAND (SM) Dense, dry, fine-grained, slightly cemented.	
		12				
		13			Test pit terminated at 13 ft bgs.	
		14				
		16				
		18				

Location: See Site Plan
Surface Elevation:

Date Completed: 6-30-04
Logged By: CJL

USG
Plaster City
Plaster City, California

CDM

Test Pit TP-15
Project No: 19921.38072

Figure: A-16
1 of 1

TEST PIT_TEMP USG 38072 PC.GPJ CDM_BLLV.GDT 7/15/04 REV.

Test Pit TP-16

DRAFT

Other Tests	OVM (ppm)	TVH	Depth (feet)	Sample	Symbol	DESCRIPTION	Elev. (feet)
			0			LIGHT BROWN SILTY SAND (SM) Medium dense, dry, fine- to medium-grained with trace gravel.	
			2				
			4			Becomes slightly cemented.	
			6				
			8			Large cobbles present (12").	
						Test pit terminated at 9 ft bgs.	
			10				
			12				
			14				
			16				
			18				

Location: See Site Plan
Surface Elevation:

Date Completed: 6-30-04
Logged By: CJL

CDM

USG
Plaster City
Plaster City, California

Test Pit TP-16 Figure: A-17
Project No: 19921.38072 1 of 1

TEST_PIT_TEMP_USG 38072 PC.GPJ CDM_BLLV.GDT 7/22/04 REV.

DRAFT

Test Pit TP-17

Other Tests	OVM (ppm)	Depth (feet)	Sample	Symbol	DESCRIPTION	Elev. (feet)
		0			BROWNISH YELLOW GRAVELLY SAND (SW) Medium dense, dry, fine- to coarse-grained, fine-grained gravel.	
		2	G			
		4			LIGHT BROWN SILTY SAND (SM) Dense, dry, fine-grained, slightly cemented.	
		6				
		8				
		10				
		12			DARK BROWN CLAY (CL) Stiff, moist.	
		14			Test pit terminated at 12.5 ft bgs.	
		16				
		18				

Location: See Site Plan
Surface Elevation:

Date Completed: 6-29-04
Logged By: CJL

USG
Plaster City
Plaster City, California

CDM

Test Pit TP-17 Figure: A-18
Project No: 19921.38072 1 of 1

TEST_PIT_TEMP USG 38072 PC.GPJ CDM_BLLV.GDT 7/15/04 REV.

DRAFT

Test Pit TP-18

Other Tests	OVM (ppm)	TMP	Depth (feet)	Sample	Symbol	DESCRIPTION	Elev. (feet)
			0			BROWNISH YELLOW GRAVELLY SAND (SW) Medium dense, dry, fine- to coarse-grained, fine-grained gravel, with trace silt.	
			2				
			4			LIGHT BROWN SILTY SAND (SM) Dense, dry, fine-grained, slightly cemented.	
			6				
			8				
			10				
			12				
			14				
			16			Test pit terminated at 15 ft bgs.	
			18				

Location: See Site Plan
Surface Elevation:

Date Completed: 6-29-04
Logged By: CJL

CDM

USG
Plaster City
Plaster City, California

Test Pit TP-18
Project No: 19921.38072

Figure: A-19
1 of 1

TEST_PIT_TEMP USG 38072 PC.GPJ CDM BLLV.GDT 7/15/04 REV.

Test Pit TP-19

DRAFT

Other Tests	TNMP (ppm)	Depth (feet)	Sample	Symbol	DESCRIPTION	Elev. (feet)
		0			BROWNISH YELLOW GRAVELLY SAND (SW) Medium dense, dry, fine- to coarse-grained, fine- to coarse-grained gravel, with trace cobbles, slightly cemented.	
		2				
		4				
		6				
		8			DARK BROWN CLAY (CL) Stiff, moist (6" layer).	
		10			LIGHT BROWN SILTY SAND (SM) Dense, dry, fine-grained, slightly cemented.	
		12				
		14			Test pit terminated at 13 ft bgs.	
		16				
		18				

Location: See Site Plan
Surface Elevation:

Date Completed: 6-30-04
Logged By: CJL

USG
Plaster City
Plaster City, California

CDM

Test Pit TP-19 Figure: A-20
Project No: 19921.38072 1 of 1

TEST PIT TEMP USG 38072 PC.GPJ CDM BLLV.GDT 7/15/04 REV.

3.4 Closure Design

The closure cover design complies with the applicable requirements of Title 27 CCR. The design grading, cover system, and supporting engineering analyses are summarized in the following sections.

3.4.1 Grading Plan

The IWP consists primarily of gypsum waste material that when compacted to 88% of standard proctor density has a hydraulic conductivity of 2×10^{-7} cm/sec. Differential settlement or consolidation of the gypsum waste material is expected to be negligible at the site. The existing waste pile has two distinct "decks". The upper "deck" is located in the north central part of the waste pile and has elevations ranging from 130 to 136 ft. The lower "deck" occupies a significant portion of the waste pile and contains elevations from 110 to 120 ft.

A majority of the existing sideslopes are flatter than approximately 5H: 1V (horizontal to vertical).

The design of the Final Grading Plan is based on the following criteria:

- Regrade the existing waste material to achieve a minimum grade of 1% for the upper and lower decks of the waste pile. Approximately 7,452 cy of material needs to be relocated to achieve 1% minimum grades.
- Installation of diversion berms at the interface of the 1% "deck" grades, and the 5 horizontal to 1 vertical grades to intercept and divert major storm event flows to rip-rap downdrain structures.
- Installation of perimeter drainage channels to convey stormwater away from the site.
- Final grade the existing sideslopes to a maximum 5 horizontal to 1 vertical.

Title 27 Section 21090.B.1.b allows portion of the final cover to be built with grades less than three percent if the discharger proposes an effective system for diverting surface drainage from laterally-adjacent areas and preventing ponding in the flatter desk areas. The waste Pile will be graded to a minimum 1% grade to prevent ponding and to promote stormwater run-off from the waste pile area. The final cover system includes a rock armoring layer that will minimize wind and stormwater erosion of the final cover system. It is anticipated that under normal rainfall events, little or no run-off is expected at the site due to absorption of stormwater into the rock armoring layer. The drainage control system includes diversion berms, rip-rap down drain structures, and a series of perimeter drainage channels designed to minimize erosion for the 100 year-6 hour stormwater event. The 100 year-6 hour stormwater event was selected to model intense rain storms that the area experiences and to calculate stormwater runoff velocities.

Differential settlement of the final capping system will not be significant due to the geotechnical engineering properties of the gypsum material. Laboratory testing determined that when compacted, gypsum material compacts to a standard proctor density of 88% and exhibits a hydraulic conductivity of 2×10^{-7} cm/sec. It is anticipated that stormwater ponding will be limited at the site.

See Appendix B for the Final Grading Plan and Stormwater Management System Details.

3.4.2 Closure Cover System

The proposed engineered alternative cover system included in this Final Closure Plan (FCP) consists of the following cover components from top to bottom as depicted in Figure 5.

Rock Armoring (Erosion Resistant Layer): The top layer of the final cover system will be comprised of a 2-inch to 3-inch thick rock layer for the upper and lower "deck" areas, and a 3-inch to 4-inch thick rock layer for waste pile sideslopes. Prior to placement of the rock armoring layer, native seed mix will be applied.

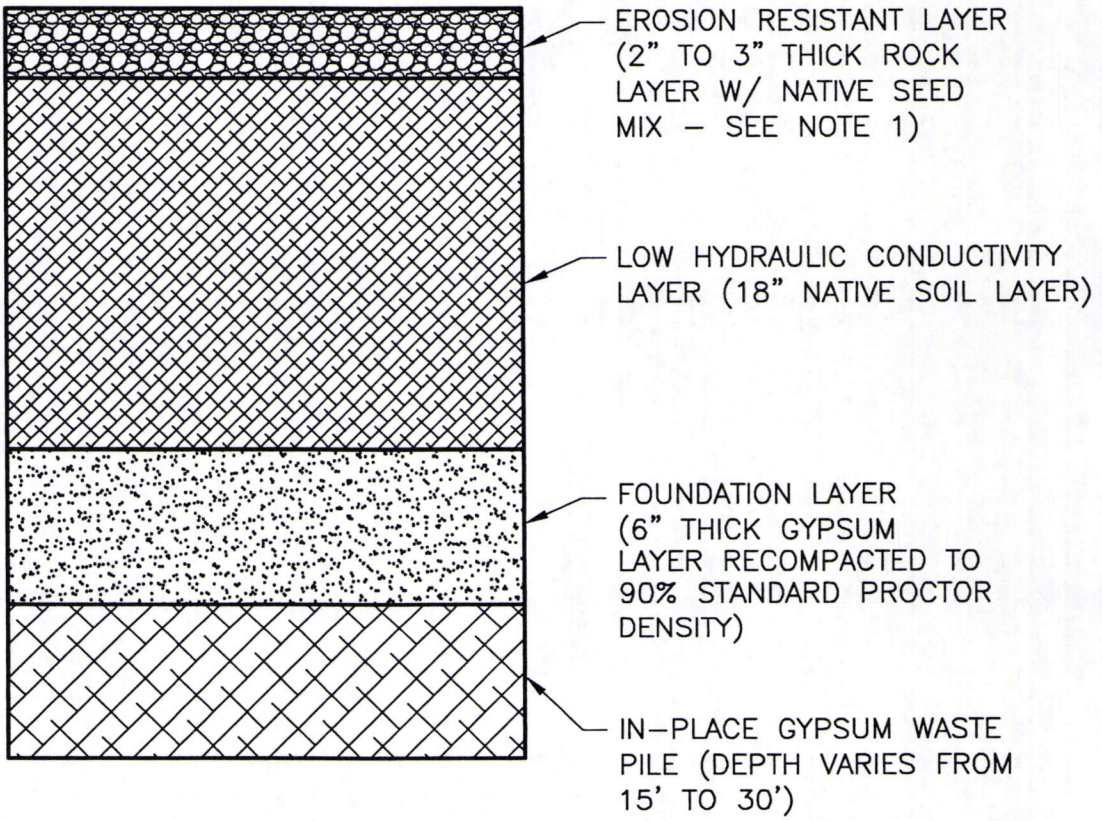
Onsite Material (Low Hydraulic Conductivity Layer): This layer consists of 18 inches of compacted native material with a hydraulic conductivity value of 2×10^{-5} cm/sec. Since the foundation layer consisting of recompacted gypsum with a hydraulic conductivity of 2×10^{-7} cm/sec is highly impermeable, onsite soil with a K value of 2×10^{-5} cm/sec is used for the low hydraulic conductivity layer. The layer will be vegetated with the following native seed mix:

Proposed Native Seed Mix

Species	Lbs/Acre
Aristida purpurea	2.0
Baileya multiradiata	2.0
Bouteloua gracilis	6.0
Eschscholzia mexicana	2.0
Atriplex canescens	6.0
Lasthenia californica	1.0
Lupinus bicolor	2.0
Poa secunda	3.0
Phacelia campanularia	2.0
Salvia columbariae	1.0
Encelia farinosa	4.0
Hordeum depressum	3.0
Vulpia octoflora	2.0
Larrea tridentata	4.0
Total Lbs/Acre	**40.0**

Gypsum Layer (Foundation Layer): The base cover system is comprised of a 6-inch thick gypsum layer recompacted to 90% standard proctor density with a hydraulic conductivity of 2×10^{-7} cm/sec.

See Appendix C.4 for gypsum and proposed cover material geotechnical information.



NOTE:

1. INCREASE ROCK ARMORING LAYER TO 3" TO 4" THICK FOR SIDE SLOPES.

FINAL COVER DETAIL

Figure 5

CDM

3.4.3 Settlement

The IWP, consisting primarily of gypsum, will not experience significant settlement or consolidation after closure.

3.4.4 Infiltration

One of the primary purposes of the cover system is to minimize infiltration into the underlying gypsum pile. The WinUnsat-H model was used to evaluate the relative infiltration performance of the prescriptive cover and engineered alternate cover system. The WinUnsat-H model computes the water balance of the cover system taking into account precipitation, evaporation, soil storage and percolation.

The analysis was conducted using precipitation data for El Centro, California. Rainfall data for the wettest 10-year period on record was used for model simulation. The average annual rainfall in the area during this period (1989 - 1998) was 4.8 inches.

The prescriptive cover system used for evaluation is based on the requirements listed in the Title 27, section 21090 (a) (1-3). The cover layer is assumed to consist of the following components from bottom to top:

1. A two-foot foundation layer consisting of onsite soil with a K value of 2×10^{-5} cm/sec.
2. A one-foot low hydraulic conductivity layer with a K value of 1×10^{-6} cm/sec.
3. A one-foot thick mechanically erosion-resistant layer of cobbles.

As described in section 3.4.2, the alternative cover-system that was used in the model evaluation consists of the following components:

1. A 6-inch thick foundation layer consisting of gypsum recompacted to 90% standard proctor density and a K value of 2×10^{-7} cm/sec.
2. An 18-inch thick layer of onsite soil with a K value of 2×10^{-5} cm/sec.
3. A two to three inch thick mechanically erosion-resistant rock layer.

For modeling purposes, plants or vegetation are assumed to be absent in the simulation for both the prescribed and alternate covers. Also, the mechanically erosion-resistant rock layers (with a high hydraulic conductivity) were not included in the infiltration analysis.

Simulation results for the period are listed in Table 3.

Table 3
Infiltration Evaluation

Cover	Average Annual Precipitation over the 10 Wettest Year Period (inches)	Total Annual Drainage through Cover (cm)	Total Annual Drainage though Cover (inches)
Prescriptive	4.75	1.88	0.74
Alternate	4.75	1.67	0.66

Based on the modeling results, the engineered alternate cover will have lower drainage through the foundation layer than the prescriptive cover.

See Appendix C.1 for the WinUnsat-H model results.

3.4.5 Stability

The stability of the Plaster City Gypsum Landfill cover was evaluated as part of the design for the final cover of the landfill. The analysis was conducted in accordance with CIWMB requirements as noted in CCR Section 21750 (f) (5) Stability Analysis. The Stability Analysis is included in Appendix C.2. The results of the analysis indicate that the proposed cover slopes will have adequate factors of safety under static (minimum FS of 4.40) and seismic (1.56) loading.

3.4.6 Erosion

The rock armoring layer will significantly minimize soil erosion from the final capping system. The rip-rap down drain structures will provide an additional level of erosion control during severe storm events.

3.4.7 Drainage

Closure drainage controls consist of a series of stormwater control features to efficiently convey stormwater off and away from the waste pile. A series of diversion berms/drainage swales will direct stormwater sheet flow off of the upper and lower decks of the waste pile to riprap lined downdrains. A perimeter drainage channel will be constructed to collect flow from downdrains and other slopes and divert major stormwater flows away from the site. Due to the rock armoring layer and limited rainfall at the site, stormwater run-off from the waste pile will be limited to major storm events. The stormwater control structures are designed to withstand a 100 year-24 hour storm event. For normal precipitation events, the rock armoring and native soil layers will absorb a majority of the stormwater and discharge from the waste pile is not anticipated. A stormwater and hydrology analysis is included in Appendix C.3.

3.5 Construction Documents and CQA

Final construction documents will be prepared and submitted at least 60 days prior to closure. A registered Civil Engineer or Certified Engineering Geologist in the State of California will supervise the preparation of final construction drawings, specifications, and a construction quality assurance plan. Appendix D includes a Construction Quality Assurance (CQA) Plan that addresses the closure design described in the Final Closure Plan. This plan may be modified during the preparation of the final closure documents to address final construction plans.

CQA will be implemented during closure to verify that the construction complies with approved construction drawings, specifications, and the CQA Plan. The CQA activities will be completed under the supervision of a Registered Civil Engineer or Certified Engineering Geologist in the State of California as required by Title 27 CCR.